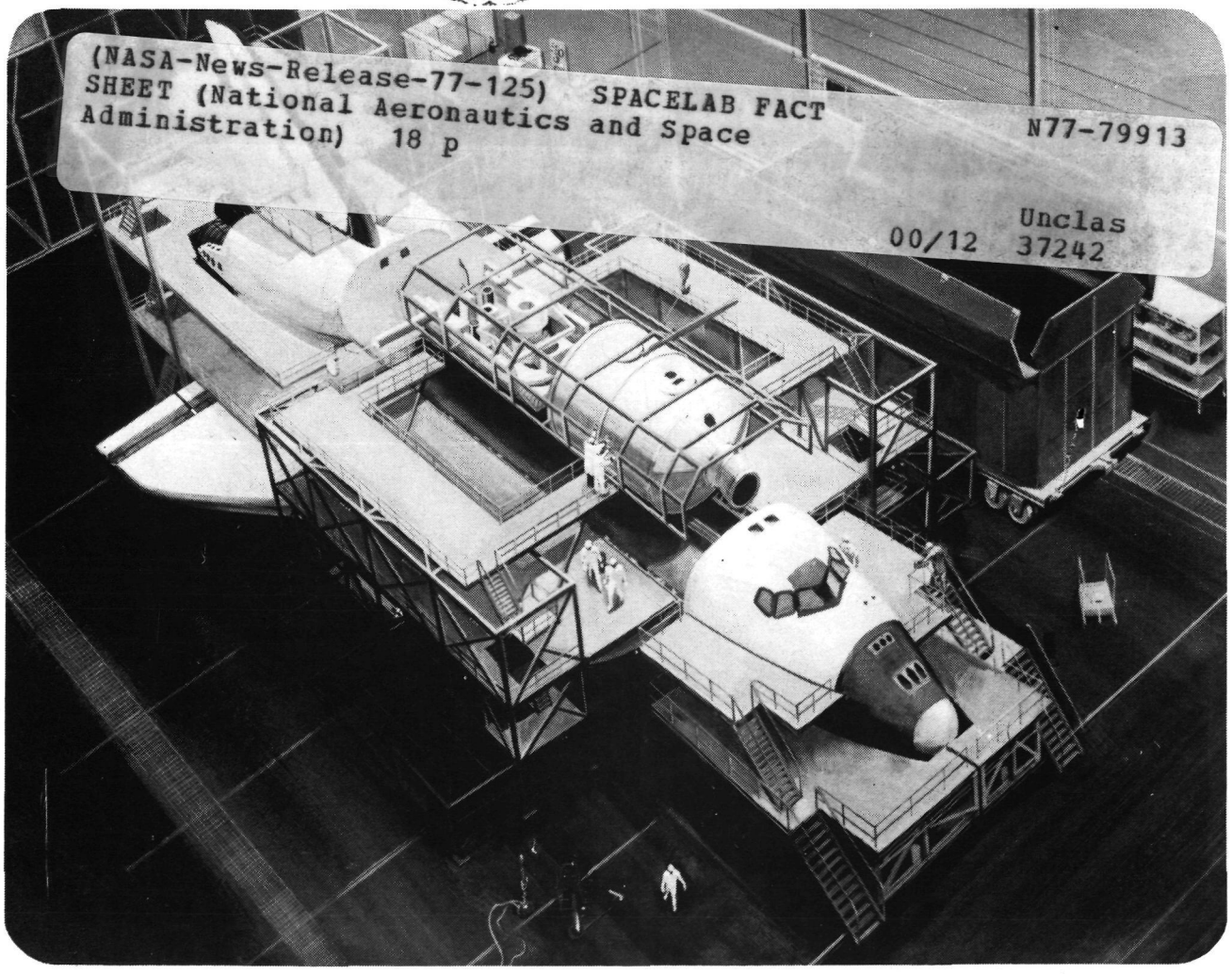
NASA
National
Aeronautics and
Space
Administration

SPACELAB
Fact Sheet

June 1977



NOTE TO EDITORS: This fact sheet describes Spacelab, one of the first major orbiting payloads planned for NASA's Space Shuttle missions in the 1980s. A co-operative venture by NASA and the European Space Agency, its onboard systems and equipment and planned contributions to space science are summarized. It is suggested that this material be retained in your files for future reference.

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RELEASE NO: 77-125

SPACELAB

In the 1980s, reasonably healthy men and women of many nations who need to go into space to conduct important scientific and technical experiments will be provided that opportunity through Spacelab. Spacelab supplies experimenters with a fully furnished laboratory adapted for the weightless environment of space and pressurized for working without spacesuits.

Spacelab development is financed by 10 European nations under agreements concluded with the European Space Agency (ESA).

Spacelab will be carried in the cargo bay of the Orbiter, the element of the Space Shuttle that is piloted into Earth orbit to conduct assigned activities and afterwards is brought back to Earth, landing like an airplane. The Shuttle is scheduled to begin operational round trips between the ground and Earth orbit in 1980. Permitting comparatively easy and frequent access to space for people, equipment and spacecraft, it is also expected to reduce the expense and increase the benefits of space operations.

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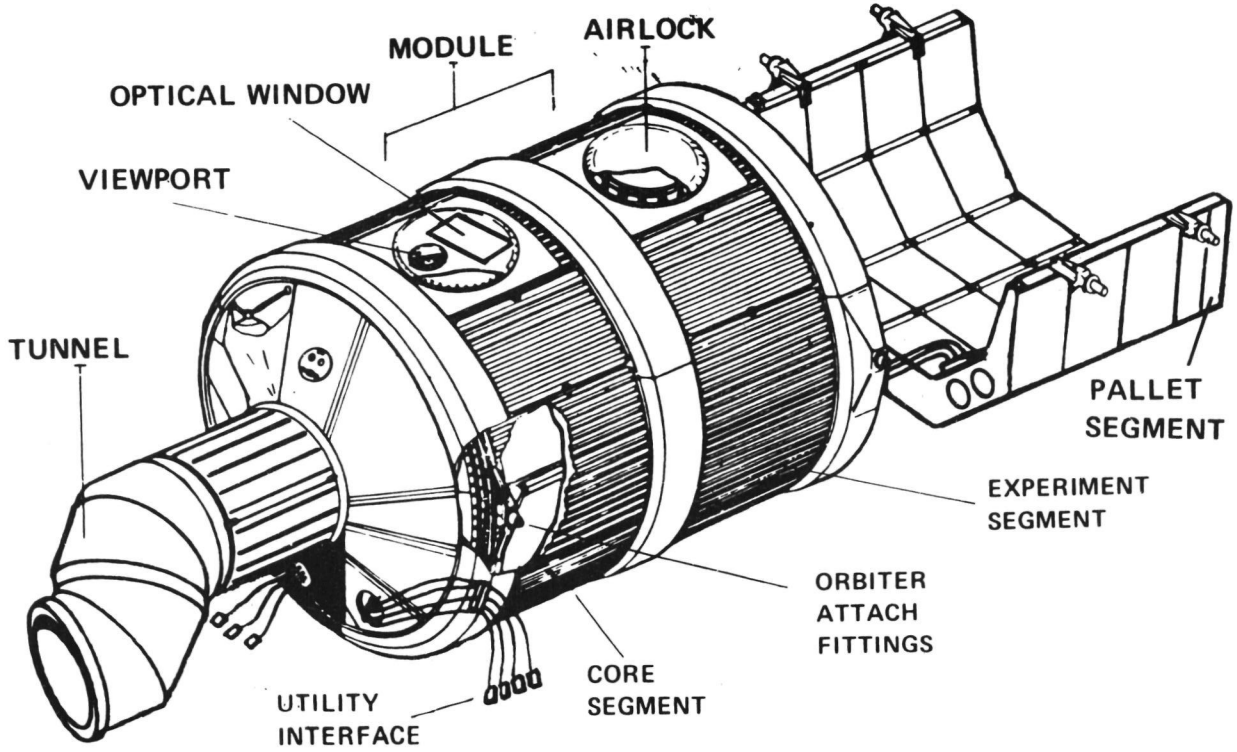
Modularized Design Promotes Efficiency

Developed on a modular basis, Spacelab can be varied to meet specific mission requirements. Its two principal components are the pressurized module which provides a laboratory with a shirtsleeve working environment and the open pallet that exposes materials and equipment directly to space. Each module is segmented, permitting additional flexibility.

The pressurized module, or laboratory, comes in two segments. One, called the core segment, contains supporting subsystems such as data processing equipment and utilities for both the pressurized modules and the pallets. It also has laboratory fixtures such as floor-mounted racks and work benches and supplies and appropriate working space. The second, called the experiment segment, is used to provide more working laboratory space. It contains only floor-mounted racks and benches. When only one segment is needed, the core segment is used.

Each pressurized segment is a cylinder 4.1 meters (13 1/2 feet) in diameter and 2.7 m (9 ft.) long. When both segments are assembled with end cones (see illustration), their maximum outside length is 7 m (23 ft.).



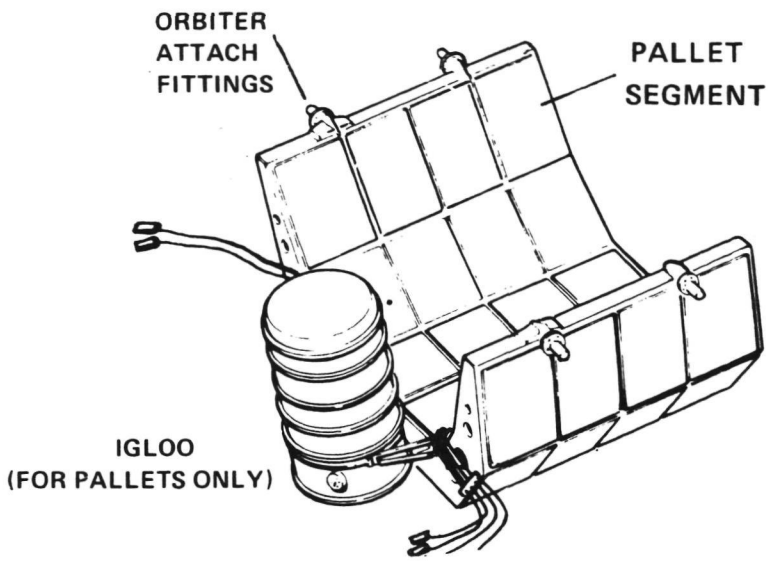
PRINCIPAL COMPONENTS OF SPACELAB.

A tunnel connects the pressurized laboratory with the pressurized cabin of the Shuttle Orbiter. The tunnel is also segmented so that its length can be varied. An airlock module may be attached to the tunnel to provide additional access to space.

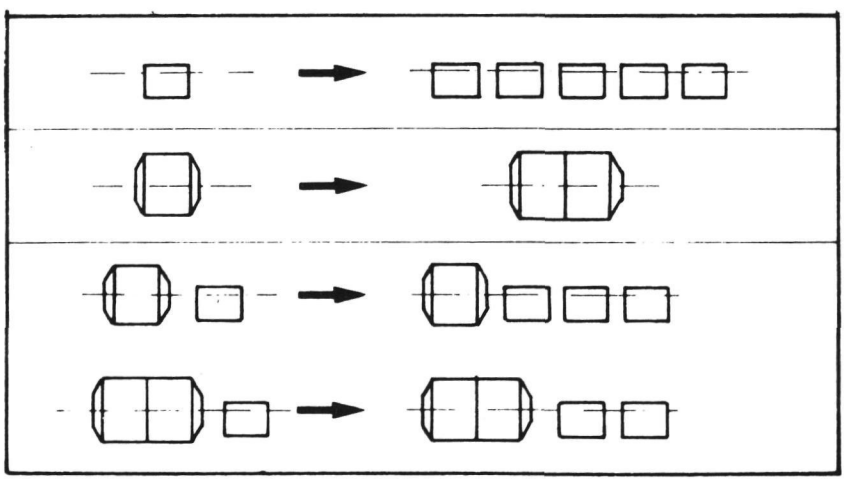
Five pallet segments, each 3 m (10 ft.) long, are available. Each pallet is not only a platform for mounting instrumentation but also can cool equipment, provide electrical power and furnish connections for commanding and acquiring data from the experiments. When only pallets are used, the essential subsystems for supporting experiments (power, communication, etc.) are protected in a small pressurized and temperature-controlled housing called an igloo.

The pallets are designed for large instruments, experiments requiring direct exposure to the space environment or those needing unobstructed or broad fields of view. Such equipment includes telescopes, antennas and sensors such as radiometers and radars.

Spacelab not only can be modified for a variety of missions but is also reusable. Each Spacelab module is designed for at least 50 space missions.



PALLET SEGMENT AND IGLOO.



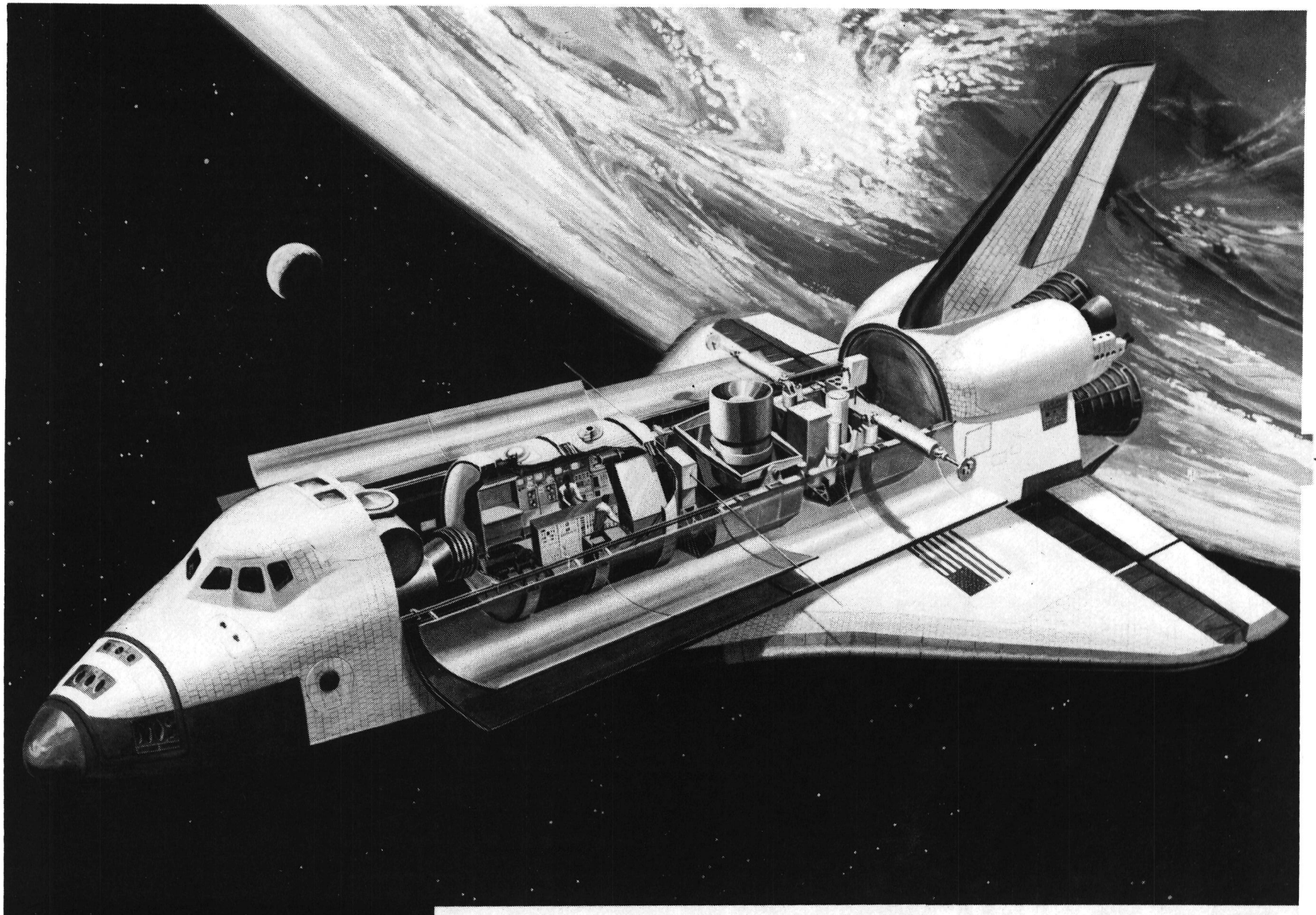
SOME POSSIBLE SPACELAB ASSEMBLIES.

Payload Specialists Need Not be Astronauts

As noted earlier, Spacelab will be open to healthy men and women of all nations regardless of whether they meet qualifications as stringent as those required for astronaut pilots. The experimenters aboard Spacelab are called payload specialists. They are nominated for flight by the organization sponsoring the payload. They are accepted, trained and certified for flight by NASA.

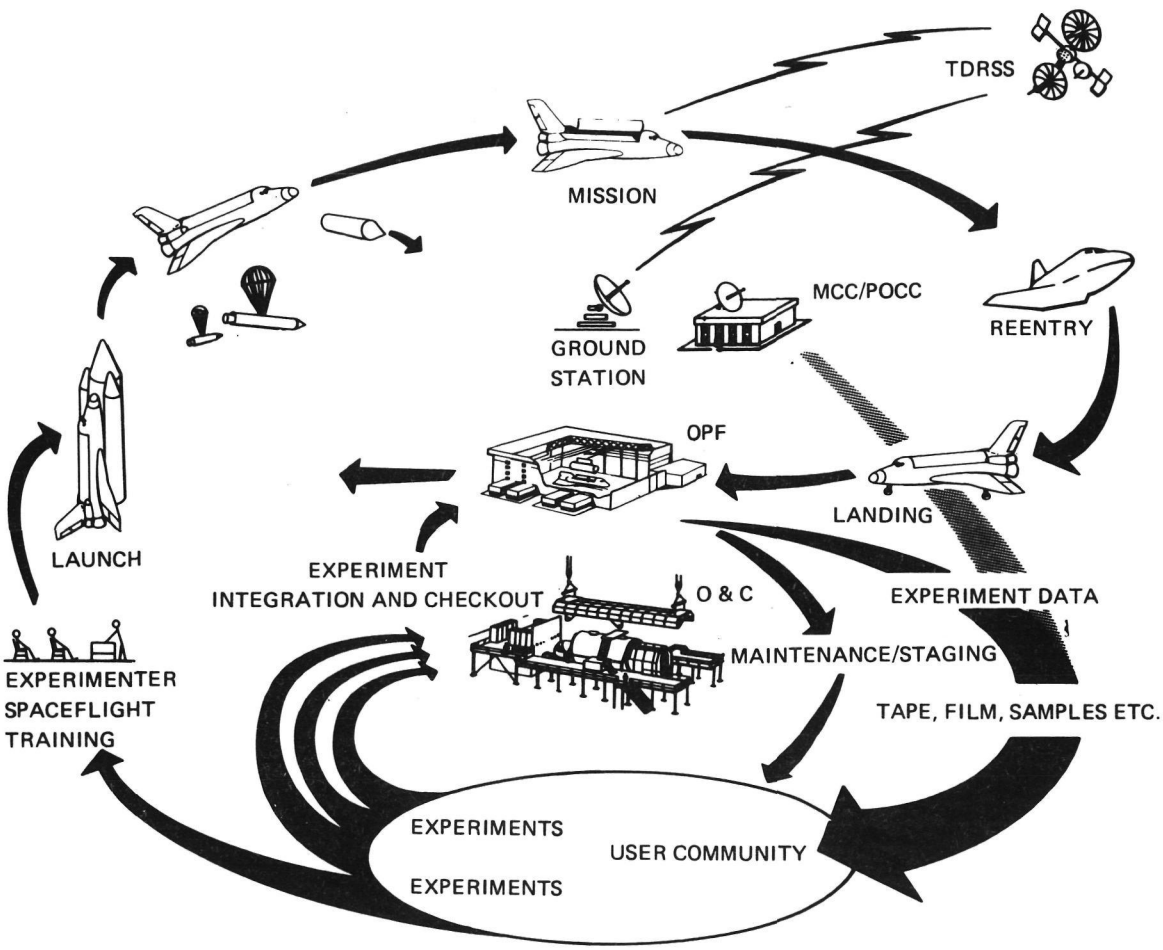
Their training includes zero gravity exercises, simulations of operations and emergencies, briefings of flight plans and procedures and space flight housekeeping.

From one to four payload specialists can be accommodated for each Spacelab flight. They coordinate their activities in space with experimenters on the ground and with the crew of the Space Shuttle. The Shuttle crew includes its commander, pilot and mission specialist. The latter is responsible for management of Shuttle resources and equipment supporting Spacelab.



Spacelab in payload bay of Orbiter in space (artist's concept).

NASA Photo: 76-H-615



MCC/POCC – Mission Control Centre/
Payload Operations
Control Centre
OPF – Orbiter Processing Facility
O & C – Operations & Checkout
TDRSS – Tracking and Data
Relay Satellite System

SPACELAB OPERATIONS PROFILE.

Spacelab to Advance Knowledge, Create New Benefits

In a typical mission, instruments and support equipment are attached to Spacelab racks and pallets. Spacelab components are assembled. The complete Spacelab is then placed in the cargo bay of the Orbiter. Appropriate utility and other connections are secured.

The payload specialists ride into space in the Orbiter cabin with the Shuttle crew. They work in Spacelab but return to the crew cabin when off duty.

Among their experiments may be the following:

- Earth surveys. Payload specialists will test and calibrate sensors and other instruments that will later be used in automated Earth observation satellites. In the process, they are expected to gather a variety of information useful in transportation, urban planning, pollution control, farming, fishing, navigation, weather forecasting and prospecting.

- Astronomy. These observations are designed to add to knowledge about our Sun and its interactions with Earth's environment, to view transient events such as comets and novas and to make observations of high energy radiation from the far corners of the Universe.

This radiation -- gamma rays, X-rays, ultraviolet light -- does not for the most part pass through Earth's protective atmosphere and, as a result, cannot be studied from Earth. But locked in it are answers to many questions about the nature, origin and evolution of celestial phenomena and additions to knowledge about our solar system and planet. Spacelab will also validate telescopes and other instruments for automated astronomy satellites.

• Life Sciences. Studies of man and other living things in space have indicated significant metabolic changes resulting from absence of gravity. Continued study is expected to increase understanding of these changes which will add to knowledge of life processes and contribute to the advancement of medicine.

• Biomedicine. The stable gravity-free environment of space has demonstrated significant advantages in separating and purifying biological particles. Thus, space processing provides increased opportunities for removal from vaccines of impurities that cause undesirable side effects and for isolating specific cells or antibodies for treatment of disease.

• Industrial technology. Zero gravity lends itself to manufacturing of new alloys and other composite materials that are uniquely strong, lightweight and temperature-resistant. It also has proved conducive to growing of very large crystals of high purity for use in electronics and to creating pure glass -- free of container contamination -- for optical, electronic and laser uses.

Payload specialists will conduct experiments in space from seven to 30 days. They will be able to obtain preliminary interpretations of data from their experiments by use of data processing equipment aboard Spacelab.

The payload specialists return to the Orbiter cabin when Spacelab is shut down for the trip back to Earth. On Earth, Spacelab is removed from the Orbiter cargo bay. The experiments are removed from Spacelab to be distributed among experimenters for further analyses. Spacelab is then refurbished and readied for its next mission.

Spacelab Product of Three International Agreements

Spacelab is a result of three international agreements.

1. In March 1973, an arrangement "concerning execution (for example, financial support) for the Space Laboratory Program" was opened for signature by the European Space Research Organization (ESRO), now European Space Agency (ESA). Signatories include ESA members Belgium, Denmark, Federal Republic of Germany (West Germany), France, Italy, the Netherlands, Spain, Switzerland and the United Kingdom and, later, non-member Austria.

2. In August 1973, nine ESA countries and the United States ratified an agreement "concerning development, procurement and use of a Space Laboratory in conjunction with the Space Shuttle system."

3. In August 1973, a memorandum of understanding was concluded between NASA and ESA. Generally, it divides responsibilities as follows:

• ESA designs, develops, manufactures, tests and delivers to NASA a Spacelab engineering model, a Spacelab flight unit, spare parts and two sets of Spacelab ground support equipment; provides engineering support; and is prepared to produce additional Spacelabs.

• NASA is responsible for Spacelab operations after delivery.

Marshall Space Flight Center, Huntsville, Ala., is project manager of Spacelab for NASA. Johnson Space Center, Houston, Tex., is in charge of flight operations. Kennedy Space Center, Fla., is responsible for integration of Spacelab and Space Shuttle and for launch of Shuttle. Shuttles carrying Spacelab will at first be launched from the Kennedy Center and, later in the 1980s, from either Kennedy or Vandenberg Air Force Base, Lompoc, Calif.

Extensive International Interest and Participation in Spacelab

More than 2,000 world scientists were represented by the responses to invitations to participate in the first Spacelab mission in the 1980s. Of these, NASA and ESA selected proposals representing 222 investigators from 15 countries. The countries are Austria, Belgium, Canada, Denmark, Federal Republic of Germany, France, Italy, India, Japan, the Netherlands, Norway, Spain, Switzerland, United Kingdom and United States. The investigations planned by the 222 scientists will be conducted in orbit by Spacelab payload specialists who will be in contact with their colleagues on the ground.

Official emblem of Spacelab.

NASA Photo: 76-H-259

ASSESS Simulated Spacelab Mission

Airborne Science/Spacelab Experiment System Simulation (ASSESS) checked Spacelab techniques of operation both on the ground and in space. ASSESS I and II with payload specialists from NASA and ESA were NASA-ESA missions designed to simulate European-American Spacelab missions.

ASSESS employed Galileo II, the Convair four-engine jet transport that NASA's Ames Research Center, Mountain View, Calif., has converted into a flying research laboratory.

For ASSESS, equipment and experiments resembling those to be used in Spacelab were installed in Galileo. In addition, a mobile van parked next to the aircraft after each flight was used for living quarters. The payload specialists spent their off-duty time in the van, thus simulating the complete isolation involved in a space mission.

A total of 15 six-hour ASSESS flights were carried out. During the flights, payload specialists conducted actual scientific experiments such as Earth resources surveying, atmospheric pollution monitoring and infrared astronomy.

Giant Step in International Cooperation in Space

Spacelab is expected to make significant contributions to science, medicine, industrial processing and many other valuable fields. In perspective, however, the most important result of this international space laboratory may well be the great step forward that it represents toward global cooperation in space. It is an outstanding example of how peoples of many lands can unite their talents and resources in future space projects to benefit humanity.

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